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The September 11 attacks and their impact on mental distress in the UK

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Abstract

Using a longitudinal household panel dataset in the United Kingdom, where most interviews are conducted in September each year, we are able to show that the attacks of September 11 resulted in higher levels of mental distress for those interviewed after that date in 2001 compared to those interviewed before it. This provides one of the first examples of the impact of a terrorist attack in one country on well-being in another country.

Keywords: terrorism; September 11; mental distress.

JEL: H56; I31.

1. Introduction

Terrorism and terror attacks have long been a major international problem, with potentially serious consequences for human welfare (Frey et al, 2007). The attacks of September 11 2001 were one of the most prominent acts of terrorism in recent times but just what are the consequences of such attacks? Economists use the underlying exogeneity of terrorist attacks as a way to establish the causal relationship from those attacks to various economic outcomes, such as tourism (Enders et al, 1992), national output (Abadie and Gardeazabal, 2002), net foreign direct investment (Abadie and Garzeazabal, 2008) and urban expansion (Blomberg and Sheppard, 2007). However, terrorism only directly affects a small fraction of the capital stock (Becker and Murphy, 2001), and there are also studies that show that it does not affect all economic outcomes (e.g. Glaeser and Shapiro (2002) find that terrorism has not altered the urban form). The well-being consequences of terrorism have also been studied in terms of the birth weight of babies in areas with a higher concentration of land mines, where the causal mechanism is thought to be the effects on the stress of mothers during pregnancy (Camacho, 2008).

The terrorist attacks of September 11 2001 have stimulated quite a bit of research in their own right. For example, there is now evidence to suggest that the attacks had a detrimental effect on the financial market (Chen and Siems, 2004; Straetmans et al, 2008), New York's fiscal position (Dolfman and Wasser, 2004; Chernick and Haughwout, 2006), urban agglomeration (Abadie and Dermisi, 2008) and the demand for air travel (Blunk et al, 2006; Blalock et al, 2007).). There was also a significant increase in the number of fatal traffic accidents after 9/11 (Gigerenzer, 2004), which has been found for other terrorist attacks (Stecklov and Goldstein, 2004).

In terms of the direct well-being effects of 9/11, it has been found that survivors from damaged buildings reported substantial physical and mental health problems three years after the event (Brackbill et al, 2006). Post-traumatic stress disorder (PTSD) has been shown to be associated with direct exposure to the 9/11 attacks and the prevalence of PTSD in the New York

City metropolitan area was substantially higher than elsewhere in the country (Galea et al, 2002; Schlenger et al, 2002). Eidelson et al (2003) find a significant increase in the amount of work – in terms of the number of clients – received by psychologists working closest to Ground Zero compared to those received by their colleagues working elsewhere in the country.

The effects of 9/11 were felt elsewhere in the US. For example, PTSD was not limited to those who experienced the 9/11 attacks directly (Silver et al, 2002) although overall distress levels were within normal ranges (Schlenger et al, 2002). In a small sample from Wisconsin, Krueger (2007) found that 9/11 increased sadness temporarily and decreased enthusiasm for at least seven days after the attacks. Also, in a nationally representative sample of Americans, Lerner et al (2003) found a heightening level of fear and anger amongst the US population following 9/11.

Despite these and a range of other studies, we are unaware of any attempt to quantify the effects of the attacks on the mental distress of those outside of the attacked country. This study looks at the effects of 9/11 on the mental distress of those living in the United Kingdom. This study has two main strengths. First, we use a large longitudinal dataset, consisting of approximately 10,000 individuals, which provides us with strong statistical power to discern patterns whist controlling for individual heterogeneity and underlying trends. Second, 9/11 acts as an exogenous shock to the sampled population, which provides us with a very powerful natural experiment.

2. Data and methods

The British Household Panel Survey (BHPS) is a nationally representative of British households, which contains over 10,000 adult individuals, and is conducted between September and December of each year (started in 1991). Respondents are interviewed in successive waves and the sample has remained representative of the British population since the early 1990s. For the study to be thought of a quasi-experiment, the timing of terrorist attacks need to be exogenous and largely randomly assigned in terms of the BHPS

interviews. The 9/11 attacks were clearly exogenous to the survey and many respondents are interviewed in September each year but at a random time during that month. To avoid any seasonality biases in our inferences, we only include those interviewed in September 2001 (excluding September 11 itself). This yields a balanced panel that consists of 3,263 individuals and 16,315 observations across 5 years (1999–2003 inclusive). Keeping the same individuals in the two groups over time allows a within-person analysis.

The measure of mental distress is the twelve items from the negative affect scale of the General Health Questionnaire (Goldberg, 1978). Respondents are asked how often (on a four point category scale) over the past few weeks they: (i) had lost sleep over worry; (ii) felt constantly under strain; (iii) felt they could not overcome difficulties; (iv) been feeling unhappy and depressed; (v) been losing confidence; (vi) been feeling like a worthless person; (vii) were playing a useful part in things; (viii) felt capable of making decisions; (ix) been able to enjoy day-to-day activities; (x) been able to concentrate; (xi) been able to face up to problems; and (xii) been feeling reasonably happy. The number of times a person places himself or herself in the top two categories was given a one, and then all twelve questions were added together to produce the so-called 'caseness score', in which higher numbers correspond to higher levels of mental distress. This composite rating is a good proxy for the transient component of negative affectivity (Watson and Clark, 1984) and has been used as a measure of mental well-being in recent studies by economists (Blanchflower and Oswald, 2007; Clark and Etile, 2002; Gardner and Oswald, 2007; Jones and Wildman, 2008; Wildman, 2003) and to value intangible goods (e.g. Oswald and Powdthavee, 2008).

Given the quasi-experiment nature of our study, we first examine the raw difference in GHQ means between the pre- and post-9/11 groups from 2000 and 2001. We then include the covariates that affect GHQ and the underlying GHQ trend, so as to control for some spurious correlations between some omitted variables affecting the GHQ after 11th September, and the underlying GHQ trend. The control covariates are consistent with the determinants of well-being (Dolan et al, 2008) and include household income, age squared,

gender, education, employment status, health status and regional dummies. We also control for the pre- and post-9/11 seasonal effects by including dummies for the month interviewed in the waves before and after 2001.

3. Results

Figure 1 shows that the average levels of mental distress for both pre and post-9/11 groups follow a very similar trend in the years that precede 2001. The trend however diverges in the year 2001. That is, the average level of mental distress of those interviewed post-9/11 in 2001 remains high in 2001 when it should have fallen along the same path as the average level of mental distress of the pre-9/11 group. Since both groups have already been exposed to the event by the time the survey was conducted in 2002, it is not surprising to see that this difference disappears one year after the 9/11 attacks.

Now consider only 2000 and 2001 using a basic difference-in-difference estimator. Any change in means between the two groups over the two years must come from 9/11. The results suggest a 0.384 increase in mental distress from the terrorist attacks. Of course, this does not control for the underlying GHQ trend over the five years or any other covariates and so Table 1 presents the random-effects regression. There is a significant increasing trend in mental distress for both groups in 2000, but then it decreases only for the pre-9/11 group. We find that the difference-in-difference estimator, or average treatment effect, is 0.377 GHQ points.

We find that using fixed effects instead of random effects, a seven-year instead of a five-year panel, and restricting the sample to only those who are interviewed pre- or post-9/11 in every year, all make little difference to these results. Given that we have more than two time periods in our analysis, there is the potential for serial correlation which understates the standard deviation of the estimated treatment effects, leading to an overestimation of the *t*-statistic (Bertrand et al, 2004). We test for serial correlation in our errors and find that our model has a Durbin-Watson statistic of 1.85, so we introduce AR(1) errors into our regression, which increases the standard error by an

negligible amount and produces an identical average treatment effect. It could still be the case that individuals interviewed immediately after 9/11 are driving the results, and so we additionally divided the post-9/11 group into two groups: interviews that took place September 12-20 and 21-30. We can find no evidence of a difference between these two groups. These robustness regressions are presented in the Appendix.

4. Discussion

This study has shown that the 9/11 attacks in the United States increased the mental distress of United Kingdom residents – by a GHQ score of 0.377. Comparing this magnitude with other life events within our data is difficult since many events, such as marriage or being unemployed, are endogenous. Notwithstanding this, the magnitude of the 9/11 effect is potentially worse than becoming divorced, and about one-third of the effect of being unemployed or widowed in the same sample using the same methods. These are significant and robust effects.

More speculatively, we can extrapolate beyond these data and consider how many people in the UK may have been affected by 9/11. A GHQ score of around 10 is a conservative threshold level at which higher levels of mental distress can be diagnosed as clinical depression (Goldberg et al, 1998), and so we can see how many people in the United Kingdom may have suffered the equivalent of clinical depression as a result of the 9/11 attacks. From the BHPS sample in 2001, there were 253 people between a GHQ value of 10 and 10.99. A 0.377 change in mental distress at this part of the distribution represents 95 people. That is, 95 individuals, or 0.5% of the BHPS sample, could have been diagnosed with clinical depression as a result of 9/11. Aggregating this up to the 45.5 million adults in the UK in 2001, 227,000 UK residents may have experienced clinical depression as a result of 9/11. Our data suggest that a disproportionately high number of these would have been younger, poorer, female and single. This analysis therefore lends itself to a valuation of the September 11 attacks through treatment expenses, and provides a different way of valuing intangibles from other subjective well-

being studies that use an income compensation (e.g. van Praag and Baarsma, 2005; Dolan and Metcalfe, 2008; Oswald and Powdthavee, 2008).

Whatever the precise scale the impact of 9/11 across the UK population, it is possible that individuals in the UK were affected by 9/11 because they believed that such events were more likely to happen in the UK in the near future, thereby increasing their fear and uncertainty. Given Krueger and Laitin's (2008) finding that terrorists are more likely to attack wealthy countries, it seems natural for individuals in other wealthy countries to be affected by terrorist attacks overseas. Indeed, the results from our study support the Caplin and Leahy (2001) model where the events that caused the initial fear and uncertainty took place in another country.

We can only speculate about such issues here as there has certainly been little discussion of the international spillover effects of security or terrorism. The US Congress Joint Economic Committee (2002) has suggested that some of the largest costs of terrorism were the difficult to measure costs of added anxiety, stress, and mental disorders associated with the increased threat of terrorism. These costs may also have been quite significant outside of the US too. We hope that this paper has provided further impetus to the analysis of the impact of terrorism.

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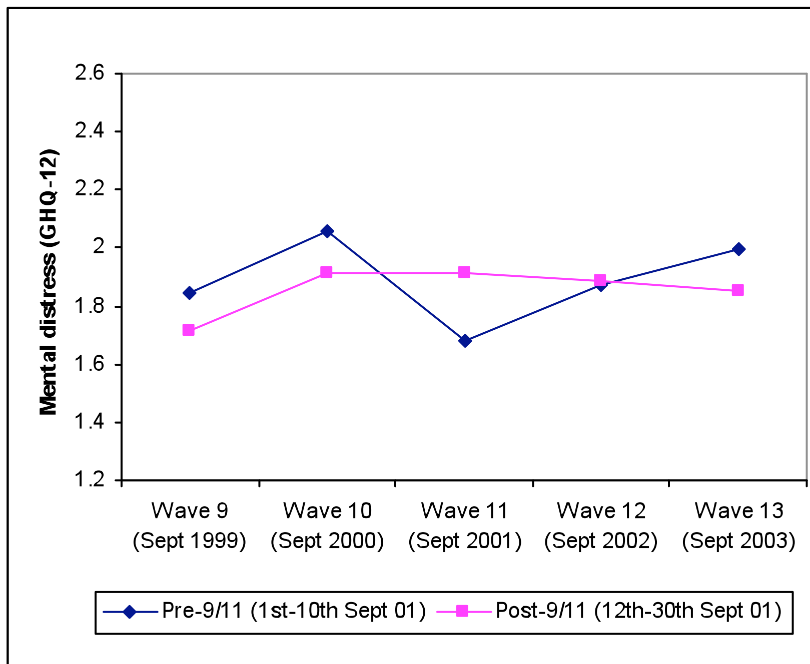
Figure 1: Changes in mental distress due to 9/11



Note: This is a balanced panel, with 727 individuals completed the survey between 1st of September 2001 and 10th of September 2001, and 2,536 individuals completed the survey between September 12th 2001 and September 30th 2001. The same individuals are tracked over the 5-year period from 1999 to 2003.

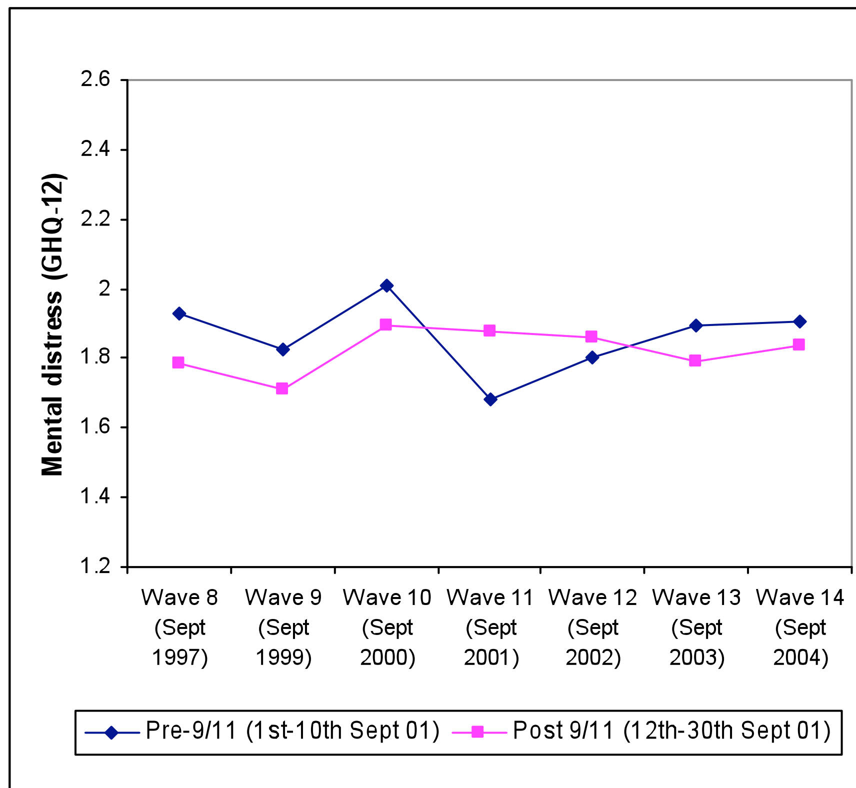
Table 1: Random effects regression of 9/11 on mental distress (GHQ)

Dependent variable: Mental distress	**Coefficient**
Treatment group	-0.142 [0.127]
T = 2000	0.255 [0.117]**
T = 2001	-0.087 [0.118]
T = 2002	0.102 [0.118]
T = 2003	0.220 [0.118]*
T = 2000 x Treatment group	-0.023 [0.132]
T = 2001 x Treatment group	0.377 [0.133]***
T = 2002 x Treatment group	0.102 [0.134]
T = 2003 x Treatment group	-0.025 [0.133]
Constant	2.912 [0.545]***
Regional dummies (20)	Yes
Month interviewed dummies (9)	Yes
Background variables (20)	Yes
Observations	16,214
Number of individuals	3,263
Overall R-squared	0.05

Note: Standard errors are in parentheses. ***<1%; **<5%; *<10% significance levels. Background variables include age^2/100, log of household income, employment status (9), education (6), and marital status (5).

Appendix

Changes in mental distress due to 9/11 – seven year balanced panel



Note: This is a balanced panel, with 655 individuals completed the survey between 1st of September 2001 and 10th of September 2001, and 2,285 individuals completed the survey between September 12th 2001 and September 30th 2001. The same individuals are tracked over the 5-year period from 1999 to 2003.

Robustness regressions of 9/11 on mental distress (GHQ) – 5-year panel

Dependent variable: Mental distress	**Fixed effects**	**AR(1) errors RE**
Treatment group	-	-0.143 [0.126]
T = 2000	0.252 [0.123]**	0.255 [0.115]**
T = 2001	-0.078 [0.140]	-0.089 [0.120]
T = 2002	0.113 [0.165]	0.102 [0.120]
T = 2003	0.237 [0.195]	0.220 [0.120]
T = 2000 x Treatment group	-0.014 [0.133]	-0.022 [0.130]
T = 2001 x Treatment group	0.384 [0.133]***	0.377 [0.135]***
T = 2002 x Treatment group	0.117 [0.135]	0.103 [0.136]
T = 2003 x Treatment group	-0.023 [0.134]	-0.025 [0.136]
Constant	2.905 [1.172]**	2.868 [0.549]***
Regional dummies (20)	Yes	Yes
Month interviewed dummies (9)	Yes	Yes
Background variables (20)	Yes	Yes
Observations	16,214	16,214
Number of individuals	3,263	3,263
Overall R-squared	0.02	0.05

Note: Standard errors are in parentheses. ***<1%; **<5%; *<10% significance levels. Background variables include age^2/100, log of household income, employment status (9), education (6), and marital status (5). $^\Psi$ Restrict the sample to only those who are interviewed pre- or post-9/11 in every year – so we have the possibility of different people in different groups each year.

Robustness regressions of 9/11 on mental distress (GHQ) – 7-year panel

Dependent variable: Mental distress	**Seven year panel (RE)**
Treatment group	-0.177 [0.132]
T = 1999	-0.116 [0.125]
T = 2000	0.089 [0.125]
T = 2001	-0.201 [0.125]
T = 2002	-0.073 [0.126]
T = 2003	0.002 [0.126]
T = 2004	0.035 [0.126]
T = 1999 x Treatment group	0.038 [0.142]
T = 2000 x Treatment group	0.045 [0.142]
T = 2001 x Treatment group	0.361 [0.141]***
T = 2002 x Treatment group	0.183 [0.142]
T = 2003 x Treatment group	0.053 [0.142]
T = 2004 x Treatment group	0.054 [0.142]
Constant	3.323 [0.490]***
Regional dummies (20)	Yes
Month interviewed dummies (9)	Yes
Background variables (20)	Yes
Observations	20,487
Number of individuals	2,940
Overall R-squared	0.05

Note: Standard errors are in parentheses. ***<1%; **<5%; *<10% significance levels. Background variables include $age^2/100$, log of household income, employment status (9), education (6), and marital status (5).

Robustness regressions of 9/11 on mental distress (GHQ) – Two treatment groups

Dependent variable: Mental distress	Random effects
Treatment group A: 12th-20th September	-0.177 [0.136]
Treatment group B: 21st-30th September	-0.092 [0.143]
T = 2000	0.254 [.117]**
T = 2001	-0.087 [0.117]
T = 2002	0.102 [0.118]
T = 2003	0.219 [0.118]*
T = 2000 x Treatment group A	-0.033 [0.144]
T = 2001 x Treatment group A	0.289 [0.144]**
T = 2002 x Treatment group A	0.124 [0.145]
T = 2003 x Treatment group A	0.113 [0.144]
T = 2000 x Treatment group B	-0.010 [0.150]
T = 2001 x Treatment group B	0.484 [0.150]***
T = 2002 x Treatment group B	0.074 [0.151]
T = 2003 x Treatment group B	-0.195 [0.150]
Constant	2.942 [0.544]***
Regional dummies (20)	Yes
Month interviewed dummies (9)	Yes
Background variables (20)	Yes
Observations	16,214
Number of individuals	3,263

Note: Standard errors are in parentheses. ***<1%; **<5%; *<10% significance levels. Background variables include $age^2/100$, log of household income, employment status (9), education (6), and marital status (5).

Robustness regressions of 9/11 on mental distress (GHQ) – Restricting to those who are interviewed pre- and post-9/11 of every year

Dependent variable: Mental distress	**Fixed effects**
Treatment group	0.073 [0.108]
T = 2000	-0.046 [0.139]
T = 2001	-0.209 [0.152]
T = 2002	0.052 [0.173]
T = 2003	0.062 [0.203]
T = 2000 x Treatment group	0.127 [0.154]
T = 2001 x Treatment group	0.346 [0.151]**
T = 2002 x Treatment group	0.019 [0.144]
T = 2003 x Treatment group	-0.173 [0.141]
Constant	1.665 [1.243]
Regional dummies (20)	Yes
Month interviewed dummies (9)	Yes
Background variables (20)	Yes
Observations	18,161
Number of individuals	6,730

Note: Standard errors are in parentheses. ***<1%; **<5%; *<10% significance levels. Background variables include $age^2/100$, log of household income, employment status (9), education (6), and marital status (5).

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